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# Programable Location & Identification Beacon

## Instalation Guide

## User Manual

## Specification

## Diagnostics

**Hardware Versions 5.1 : 12V-24V DC Operation**

**Issue: 3 28th May 2015**

Powered by eAGLe Light Engines

™ Interleader Limited

**Document Revision Sheet**

| Issue | Date | Changes |
|---|---|---|
| 1 | 29th April 2015 | New Document for V5.1Hardware.<br>Version 5.1 hardware has:<br>1) Revised switch arrangements for intensity, programme and quadrant control.<br>2) New, more powerful processor<br>3) USB socket to enable user software update |
| 2 | 29th April 2015 | Details of Wireless options included<br>More electrical diagnostics included |
| 3 | 28th May 2015 | Software V5.2 including: Sunset/Sunrise switching added to all programmes |
| | | |

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**Programmable Location & Identification Beacon**

**User and Programming Guide**

The FEC Location and Identification Beacon can be programmed without any special knowledge, skills or tools before or after installation by means of on-board switches. In addition, on-board switches enable different maximum light output levels to be set and control which quadrants are active.

Users wishing to access key system and operational data as well as programme their own PIN access control codes and the Morse Code identification strings of the unit may do so with an optional interface system that works with a Windows PC.

### Part Number

HP0680P (White)

HP0681P (Red)

HP0683P (White, Green and Yellow)

### Model Characteristics

The basic models are either single colour beacons (HP0680P, HP0681P) or multi-coloured beacons (HP0683P).

The core beacon controller is the same for both but the LED arrays are different.

To simplify setup, operation and on-going support the software is pre-programmed with which sort of arrays it is fitted with (single or multi-colour) and executes a suite of programmes consistent with them.

The suite of programmes available is listed in later sections and includes a range of FAA, ICAO, CAA and Transport Canada consistent patterns for civil and military heliports and airfields.

# 1. Physical Installation

To avoid ingress of moisture, mounting and any subsequent maintenance must only be undertaken when there is no precipitation.

To begin installation, the lens clamp, glass lens and LED beacon core of the unit must be removed from the aluminium beacon base before the pole-mounted or flange-mounted base is secured to the pole or structure.

The LED beacon core is a sophisticated and delicate unit and during the fitting process must be kept dry and stored in an appropriate manner to avoid damage.

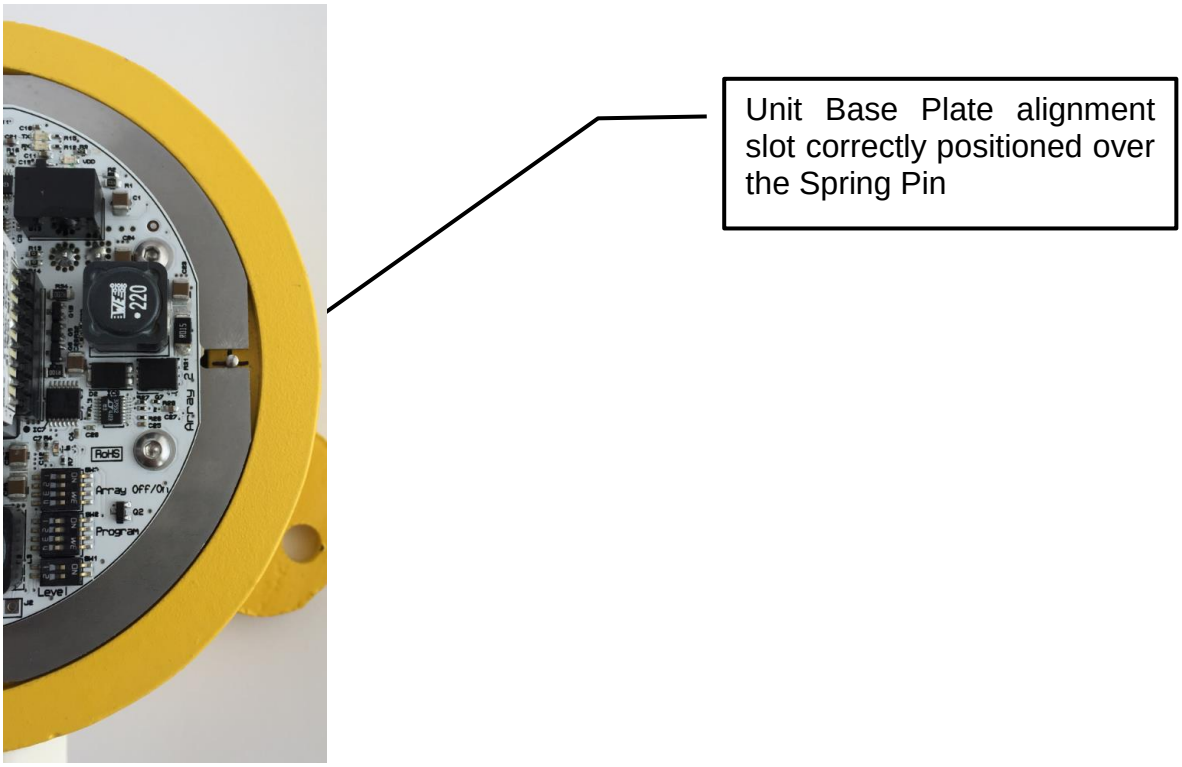
The power cable should be carefully threaded through the cable entry arrangement ensuring that the cable does not foul the internal fan or other parts of the unit.

**Alignment**

To ensure that the light pattern from the beacon is at the correct angle, a spirit level or similar must be used to ensure that the base is perfectly level.

Particlaur care must be taken with the alignment of flange mounted bases to ensure that the LED arrays, once aligned via the spring pin (below) enables the arrays to be aligned as desired. Small angular adjustments of pole-mounted bases can be performed by slackening the Alan screw and lock nut and rotating the base.

To enable correct alignment of the arrays, particularly if the Array Disable function is to be used, the pole-mounted or flange-mounted base must be oriented so that the spring pin in the recess which aligns with a locating notch in the beacon core base plate is placed in the desired direction.

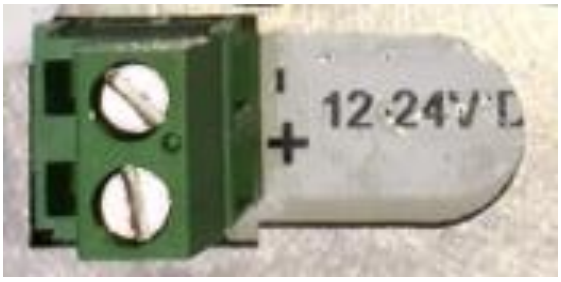


## 2. Electrical Installation

Power to the beacon is fed via the power connector on the underside of the mounting plate.

**It is essential that the correct polarity is observed or permanent damage may occur to the unit or supply.**

**Observe Polarity**



The feed to the beacon must be fused. A suitable Line Fuse Holder and Fuse (pictured below) is supplied with the beacon. The fuse must be fitted in the +ve supply cable. Note that the fuse holder has an integrated LED to show that the fuse is blown:

Fuse is 20 Amp automotive 'Blade' type which is widely available

Integrated LED lights if power is applied but the fuse is blown

### Cable Sizes

It is essential that the correct size cable is used.

| Voltage | Short Cable Run <5m (<16') | Long Cable Run >5m (16') |
|---|---|---|
| 24V | 1.0mm (18AWG) | 1.5mm (16AWG) |
| 12V | 1.5mm (16AWG) | 2.5mm (14AWG) |

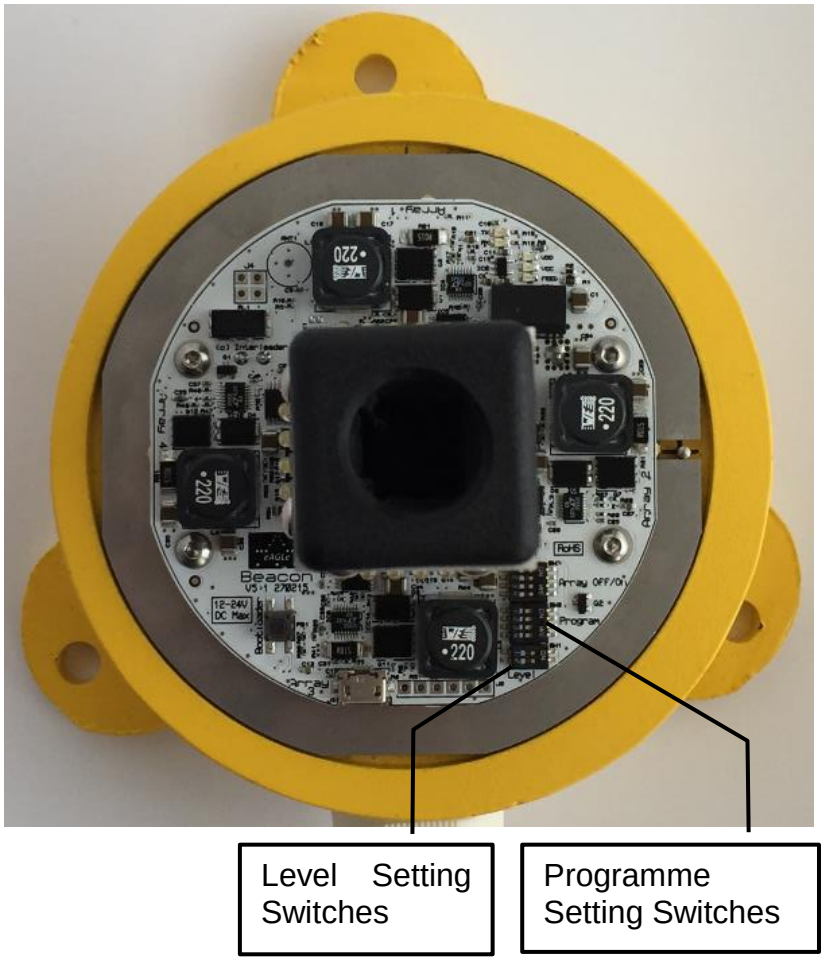
## 3. Programme and Maximum Light Level Setting

### Switch locations

The Programme and Maximum Light Level control switches are located on the edge of the main circuit board of the beacon as indicated on the diagram to the right.

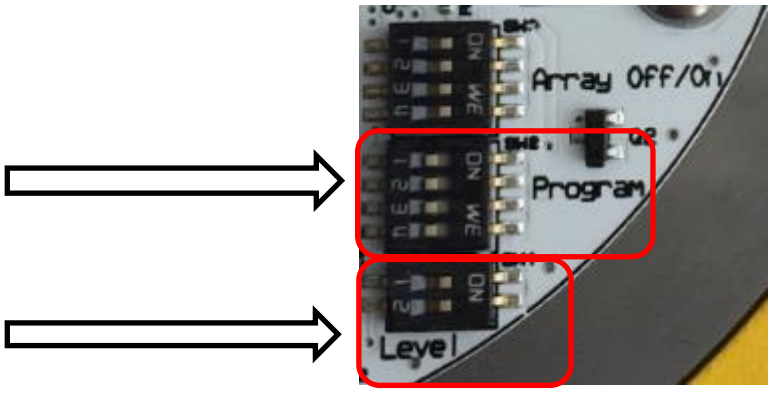
Details of their setting are described below and in the next sections. All switches can be set using the tip of a ball point pen or similar tool.

Depending on the model, the switches will be set to appropriate default values detailed below and in later sections.




### Programme and Level Setting Switches

- Programme Switches
  - 4 way switch identified as SW2 with 'Program' printed beside it. Photo shows Programme 0 selected
- Level Switches
  - 2 way switch identified as SW1 with 'Level' printed by it. Photo shows Level set to 3



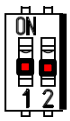
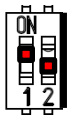
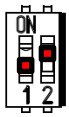
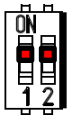
## 4. Level Setting Switches

The Level Setting switches enable the maximum flash brightness to be set to 4 levels. All changes to the level switches must be made with the unit powered off.

The switches are best moved with the tip of a stylus, jeweller's screwdriver or similar tool. Note that the switches may be covered with a protective adhesive tape. To allow changes to be made this can be removed and discarded.

Note that in this and later tables the switch actuators are shown in red for clarity.

The levels are as follows:

| Switch Setting | Value | Level |
|---|---|---|
|  | 0 | 10% of Maximum Level |
|  | 1 | 30% of Maximum Level |
|  | 2 | 60% of Maximum Level |
|  | 3 | 100% of Maximum Level<br>(Default - as set in photo on previous page) |

Note that the unit monitors the temperature of the LED arrays and if it exceeds critical thresholds will automatically reduce the LED power until the temperature recovers. This is most likely to occur at high ambient temperatures and/or dense Morse strings (see appendix for Morse timings)

## 5. Operational Modes – Single Colour Beacons

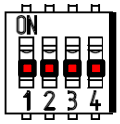
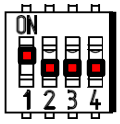
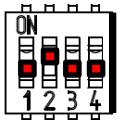
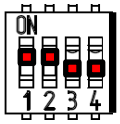
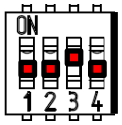
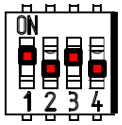
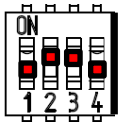
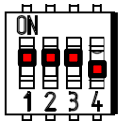
If the beacon is a single colour unit, the modes that can be selected are (see Appendix 1 and 2 for details):

- 2 Location beacon modes:
  - Modified ICAO pattern (short [2mS] and long [ 25mS] pulse) - 30 FPM
  - 25 FPM (Flashes Per Minute) UK CAA and Transport Canada timing compliant
- 2 Morse beacon modes: 4 - 6 WPM (Words Per Minute):
  - 1, 2 and 3 character code options (defined at time of ordering)
  - User programmable (with optional extra programming kit)
- Rotating (simulated) beacon mode
- 'Jump' Flash mode – Highly visible flashing mode
- Test and Setup Mode – Allows users to monitor all of the units parameters and set security PIN codes and Morse codes (with optional extra interface system)
- All of the above are available with Sunset/Sunrise switching
- There is 1 reserved programme for future development

## 6. Programme Setting Switches – Single Colour Beacons

The Programme Setting switches enable the different operating modes of the unit to be set. All changes to the Programme switches must be made with the unit powered off for them to take effect. The switches are best moved with the tip of a stylus, jeweller's screwdriver or similar tool. Note that the switches may be covered with a protective adhesive tape. To allow changes to be made this can be removed and discarded.

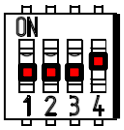
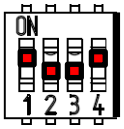
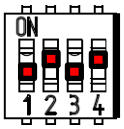
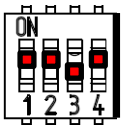
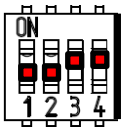
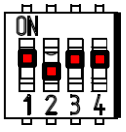
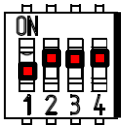
The Programmes are as follows (see Appendix 1 & 2 for detailed timing):

| Switch Setting | Value | Programme |
|---|---|---|
|  | 0 | **ICAO Helipad Beacon**<br>ICAO compliant timing |
|  | 1 | **Modified ICAO Helipad Beacon**<br>(Default Setting) Modified ICAO compliant timing giving longer flashes within the same period |
|  | 2 | **Morse Identification Beacon #1 (1, 2 or 3 Characters)**<br>Factory set default is 'H' (Transport Canada compliant)<br>Can be user programmed with optional kit |
|  | 3 | **Morse Identification Beacon #2 (1, 2 or 3 Character)**<br>Factory set default is 'TST' for Test.<br>Can be user programmed with optional kit |
|  | 4 | **Location Beacon**<br>In this mode the unit flashes at 25 Flashes/Minute consistent with UK CAA CAP168 timing requirements |
|  | 5 | **'Rotating' Beacon**<br>In this mode the LED arrays are fired in sequence to create the effect of a rotating beacon (~ 70 RPM) |
|  | 6 | **'Jump' Flash**<br>In this mode alternate pairs of LED arrays are fired to create a very visible warning pattern |
|  | 7 | **Test, Setup and Demonstration**<br>Testing, diagnostics and demonstration and for user programming with optional kit |

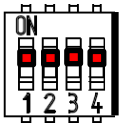
Note that to use Programme 7, (Test, Setup and Demonstration), requires a PC and the optional Terminal Programming Kit.

## 7. Sunset/Sunrise Switch Settings – Single Colour Beacon

All of the programmes listed in the previous section are available in conjunction with automatic sunset and sunrise switching.

| Switch Setting | Value | Programme |
|---|---|---|
|  | 8 | **ICAO Helipad Beacon**<br>ICAO compliant timing |
|  | 9 | **Modified ICAO Helipad Beacon**<br>(Default Setting) Modified ICAO compliant timing giving longer flashes within the same period |
|  | 10 | **Morse Identification Beacon #1 (1, 2 or 3 Characters)**<br>Factory set default is 'H' (Transport Canada compliant)<br>Can be user programmed with optional kit |
|  | 11 | **Morse Identification Beacon #2 (1, 2 or 3 Character)**<br>Factory set default is 'TST' for Test.<br>Can be user programmed with optional kit |
|  | 12 | **Location Beacon**<br>In this mode the unit flashes at 25 Flashes/Minute consistent with UK CAA CAP168 timing requirements |
|  | 13 | **'Rotating' Beacon**<br>In this mode the LED arrays are fired in sequence to create the effect of a rotating beacon (~ 70 RPM) |
|  | 14 | **'Jump' Flash**<br>In this mode alternate pairs of LED arrays are fired to create a very visible warning pattern |

The following programme is reserved for future development.

| | | |
|---|---|---|
|  | 15 | **Reserved Programme # 1** |

## 8. Operational Modes – Multi-Colour Beacons

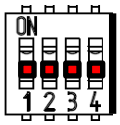
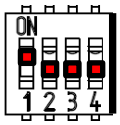
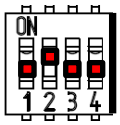
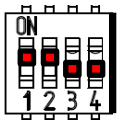
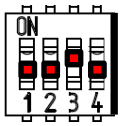
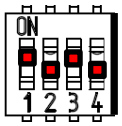
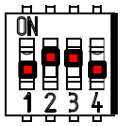
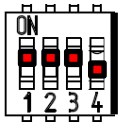
If the beacon is a multi-colour unit, the modes that can be selected are (see Appendix 1, 2 and 3 for details):

- FAA L-802H Civil Helipad Beacon
  - 36 Flashes per Minute, 75ms pulses
- FAA L-802M Military Helipad Beacon
  - 17.3 Flashes per Minute, 100ms pulses
- US Army Helipad Beacon
  - 36 Flashes per Minute, 50ms pulses
- Location beacon mode:
  - Modified ICAO pattern (25mS pulse) - 30 FPM
  - 25 FPM (Flashes Per Minute) UK CAA and Transport Canada timing compliant
- 2 Morse beacon modes: 4 - 6 WPM (Words Per Minute):
  - 1, 2 and 3 character code options (defined at time of ordering)
  - User programmable (with optional extra programming kit)
- Test and Setup Mode – Allows users to monitor all of the units parameters and set security PIN codes and Morse codes (with optional extra interface system)
- All of the above are available with Sunset/Sunrise switching
- There is 1 reserved programme for future development

## 9. Programme Setting Switches – Multi-Colour Beacons

The Programme Setting switches enable the different operating modes of the unit to be set. All changes to the Programme switches must be made with the unit powered off for them to take effect. The switches are best moved with the tip of a stylus, jeweller's screwdriver or similar tool. Note that the switches may be covered with a protective adhesive tape. To allow changes to be made this can be removed and discarded.

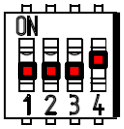
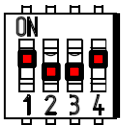
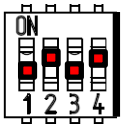
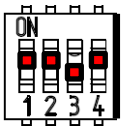
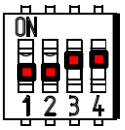
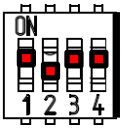
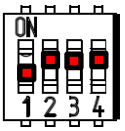
The Programmes are as follows (see Appendix 1, 2 & 3 for detailed timing):

| Switch Setting | Value | Programme |
|---|---|---|
|  | 0 | **FAA L-802H Civil Helipad Beacon**<br>(Default Setting) 36 Flashes per Minute, 75ms pulses<br>White – Green - Yellow |
|  | 1 | **Modified ICAO Helipad Beacon**<br>Modified ICAO compliant timing<br>25ms flashes within the defined cycle period |
|  | 2 | **Morse Identification Beacon #1 (1, 2 or 3 Characters)**<br>Factory set default is 'H' (Transport Canada compliant)<br>Can be user programmed with optional kit |
|  | 3 | **Morse Identification Beacon #2 (1, 2 or 3 Character)**<br>Factory set default is 'TST' for Test.<br>Can be user programmed with optional kit |
|  | 4 | **Location Beacon**<br>In this mode the unit flashes at 25 Flashes/Minute<br>consistent with UK CAA CAP168 timing requirements |
|  | 5 | **US Army Helipad Pattern (as per TM 5-811-5)**<br>36 Flashes per Minute, 50ms pulses<br>White (double Peak) – Green - Yellow |
|  | 6 | **FAA L-802M Military Helipad Beacon**<br>17.3 Flashes per Minute, 100ms pulses<br>Green – White-White |
|  | 7 | **Test, Setup and Demonstration**<br>Testing, diagnostics and demonstration and<br>for user programming with optional kit |

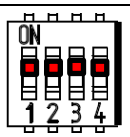
Note that to use Programme 7, (Test, Setup and Demonstration), requires a PC and the optional Terminal Programming Kit.

## 10. Sunset/Sunrise Switch Settings – Multi-Colour Beacons

All of the programmes listed in the previous section are available in conjunction with automatic sunset and sunrise switching.

| Switch Setting | Value | Programme |
|---|---|---|
|  | 8 | **FAA L-802H Civil Helipad Beacon**<br>(Default Setting) 36 Flashes per Minute, 75ms pulses<br>White – Green - Yellow |
|  | 9 | **Modified ICAO Helipad Beacon**<br>Modified ICAO compliant timing<br>25ms flashes within the defined cycle period |
|  | 10 | **Morse Identification Beacon #1 (1, 2 or 3 Characters)**<br>Factory set default is 'H' (Transport Canada compliant)<br>Can be user programmed with optional kit |
|  | 11 | **Morse Identification Beacon #2 (1, 2 or 3 Character)**<br>Factory set default is 'TST' for Test.<br>Can be user programmed with optional kit |
|  | 12 | **Location Beacon**<br>In this mode the unit flashes at 25 Flashes/Minute<br>consistent with UK CAA CAP168 timing requirements |
|  | 13 | **US Army Helipad Pattern (as per TM 5-811-5)**<br>36 Flashes per Minute, 50ms pulses<br>White (double Peak) – Green - Yellow |
|  | 14 | **FAA L-802M Military Helipad Beacon**<br>17.3 Flashes per Minute, 100ms pulses<br>Green – White-White |

The following programme is reserved for future development.

| | | |
|---|---|---|
|  | 15 | **Reserved Programme # 1** |

## 11. Quadrant Control Switches

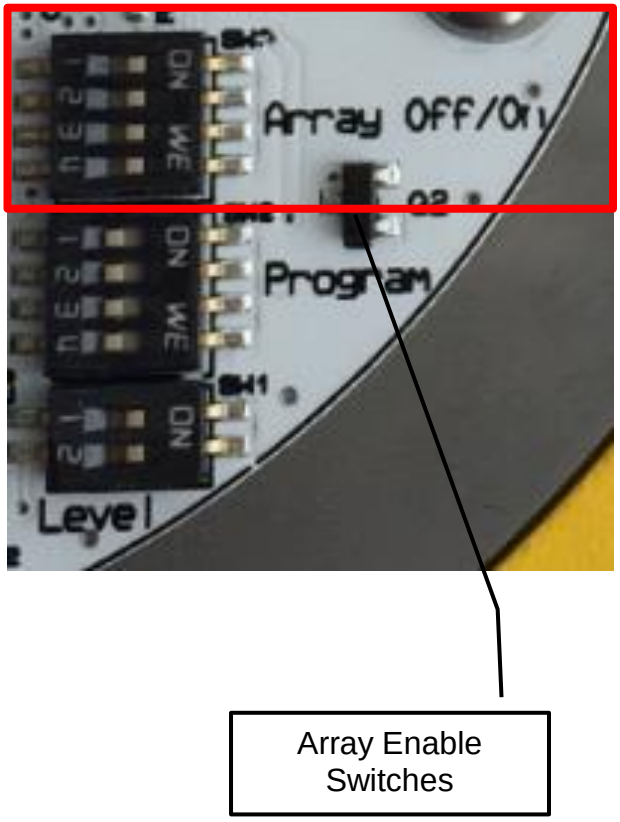
There may be situations where an operator requires that the beacon is only visible from certain directions (for example, to avoid dazzling pilots or causing a distraction).

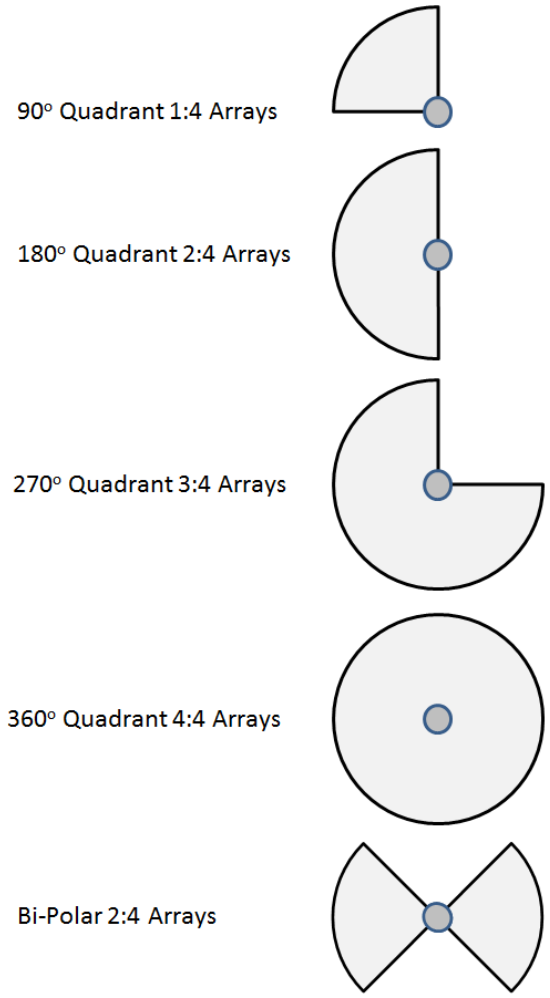
Usually this would require the operator to fit screening or similar but with the FEC Programmable Location & Identification Beacon this is simply achieved by disabling the relevant array(s) by means of switches on the main circuit board (photo below).

Each array has an 'Array Enable' switch associated with it. To disable a particular array simply slide the switch to OFF (Disable). The switches are best moved with the tip of a stylus, jeweller's screwdriver or similar tool. Note that the switches may be covered with a protective adhesive tape. To allow changes to be made this can be removed and discarded.

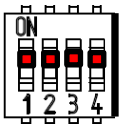
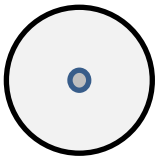
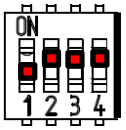
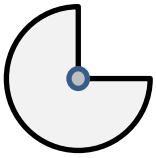
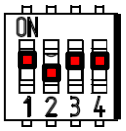
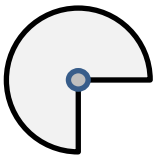
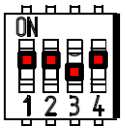
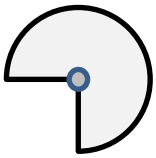
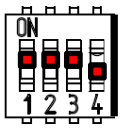
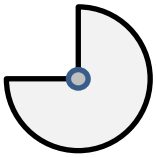
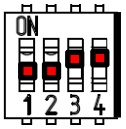
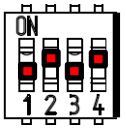
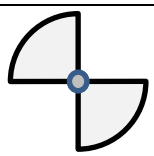
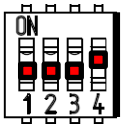
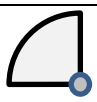
The relevant array(s) will remain permanently disabled in all programming modes until the switch(es) are turned on again.

As shipped, all of the arrays are enabled (all Array Enable switches – On) giving the full 360° pattern as shown below. Examples of array control are shown over.



**Example Array Enable Switch Settings**

| Array Enable Switch Setting | Array Condition | Light Pattern |
|---|---|---|
|  | **All Arrays Enabled (On)** |  |
|  | **Array #1 Disabled (Off)** |  |
|  | **Array #2 Disabled (Off)** |  |
|  | **Array #3 Disabled (Off)** |  |
|  | **Array #4 Disabled (Off)** |  |
|  | **Arrays #1 & 2 Disabled (Off)** | |
|  | **Arrays #1 & 3 Disabled (Off)** |  |
|  | **Arrays #1, 2 & 3 Disabled (Off)** |  |

NB: Ensure that after installation Array Enable Switches are correctly set. Failure to do so will give appearance of LED Failure

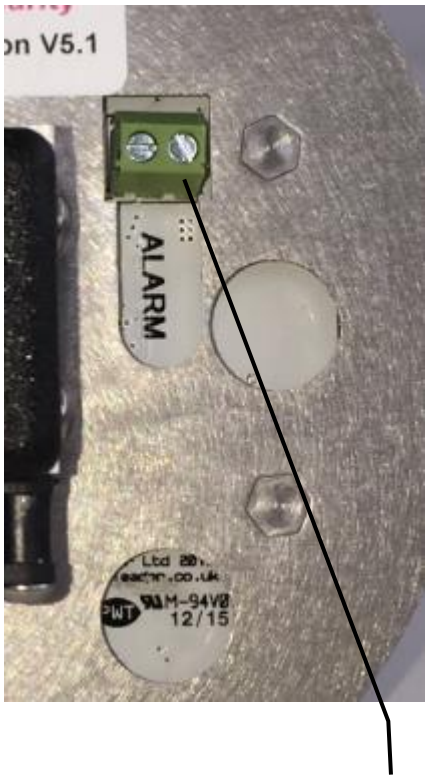
## 12. Alarm Output

The beacon is fitted with an alarm relay output for remote monitoring.

The alarm condition is flagged if:

1) The supply voltage falls below 12V
2) The array temperature gets too high
3) An array (or single colour element) of an array fails – Checked on start-up

The alarm relay output is via a terminal connector located on the underside of the main circuit board and accessed via a slot in the base plate as shown opposite:




Alarm Relay Output

The relay output is electrically isolated from the supply feed and ground and can be connected to an alarm monitoring device.

The maximum voltage, current and power are shown in the table below.

The non-alarm condition for the relay is ‘Contact Open’.

The alarm condition for the relay is ‘Contact Closed’

**Note** – For safety reasons, the beacon will attempt to operate even though it is in an alarm condition. For example if the array temperature is too high, the alarm will be set but the beacon will continue to operate at reduced power output.

| Contact Data | Condition | Max. | Units |
|---|---|---|---|
| Contact Rating | Any combination of the switching voltage and current must not exceed the given rated power | 10 | W |
| Switching Voltage | DC or Peak AC | 170 | V |
| Switching Current | DC or Peak AC | 0.5 | A |
| Carry Current | DC or Peak AC | 0.5 | A |
| Static Contact Resistance (initial) | Measured with Nominal Voltage | 250 | mΩ |

## 13. Specification

### Physical Characteristics

- 7 1/16 inches tall (177.8mm)
- 1" NPT hub for pole mounting (also available with three point flat flange mount)
- Locating pin in base to enable precise orientation for quadrant management
- Degree of protection IP66
- Operating temperature: -25$^{o}$C to +50$^{o}$C
- Storage temperature: -25$^{o}$C to +80$^{o}$C
- Long-life, quiet and low-power Internal cooling fan

### Electrical Characteristics

- Operating voltage: 12-24V DC (can operate from batteries)
- Absolute voltage range 11V – 28V DC
- Average power consumption: Less than 20 watts
- Instantaneous power consumption: 150 watts
- Electrical protection
  - Line fuse: 20 Amp (spare fuse supplied)
  - Reverse voltage protection: Schottky Diode Clamp – Will blow fuse
  - LED controllers (4 off): Short circuit and overvoltage protected
- LED Lifetime (projected): >50,00 hours

### LED Colour Characteristics

- White: 6000$^{o}$K/6500$^{o}$K 'Cool White'
- Red: 625nm
- Green: 528nm
- Yellow: 590nm

### *Options*

- Red-Orange 617nm
- Hyper Red 656nm
- Deep Blue 455nm

### Power Supply

- 100-230V 50/60Hz 240W solid state power supply
- 24V 10A DC output
- Full over-voltage protected
- Short circuit and over current protected
- Free air cooling (no fan)
- IP65 rated
- 9 ¾" long, 2 ¾" Wide, 1 ½" High (246mm Long, 70mm Wide, 38mm High)
- 1' (300mm) AC and DC connection leads

# 14. Optional Extras

### Wireless Interface Kit

- Wireless interface between a beacon (or beacons) and a PC
- Wireless interface must be specified at time of order.
- Depending on terrain and local topology has a range of 1km to allow remote monitoring of beacons

# 15. Special Orders

### Colours

At additional cost, units can be supplied with a range of colour LEDs including:

- Red-Orange 617nm
- Hyper Red 656nm
- Deep Blue 455nm

### Software Features

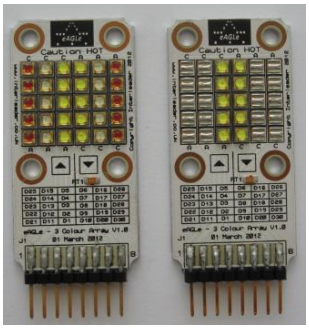
At additional cost, units can be programmed to perform non-standard patterns including:

- Different string lengths of Morse Code
- Non-standard timing flash patterns
- Co-ordinated beacon operation (requires wireless interface for all beacons involved)

## 16. Spare Parts

The following spare parts, with all tools and consumables where required, are available and can be fitted by users:

### LED Arrays



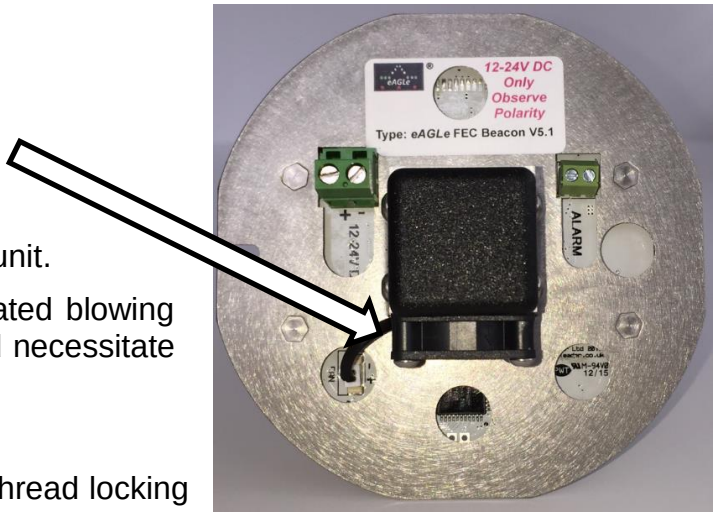
LED Array replacement kits are available for all multi-colour (left image) and single (right image) arrays. The kits comprise:

- LED array
- Allen key
- Stainless steel screws (4 off)
- Full instructions

### Cooling Fan

A cooling fan replacement kit is available comprising:

- Fan with flying lead and connector
- Allan key
- Stainless steel screws (3 off)
- Full instructions




### Fuses

A spare 'Blade' fuse is provided with every unit.

Spare fuses are widely available but repeated blowing of the fuse would indicate a major fault and necessitate the return of the unit for repair.

***Note***

For LED and Fan fitting, user must supply thread locking compound (Loctite medium 248 or similar)

### Enclosure

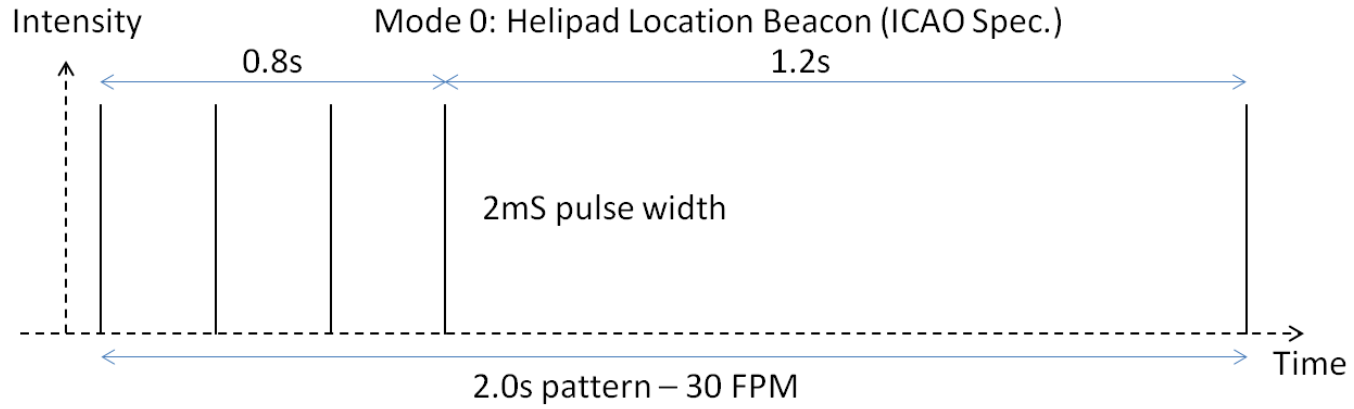
The following mechanical parts are available (no tools required):

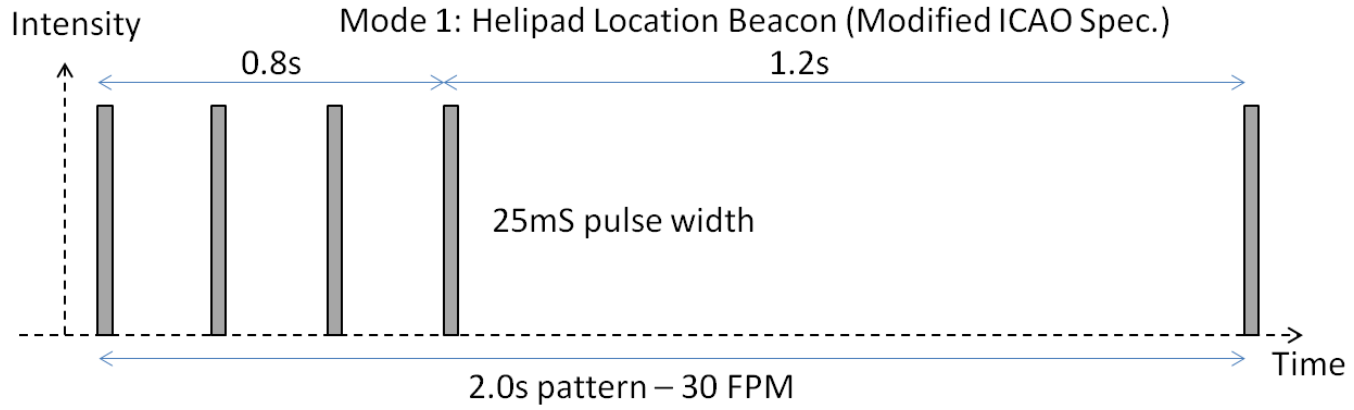
- Glass lens
- Rubber gasket
- Securing strap

### Other

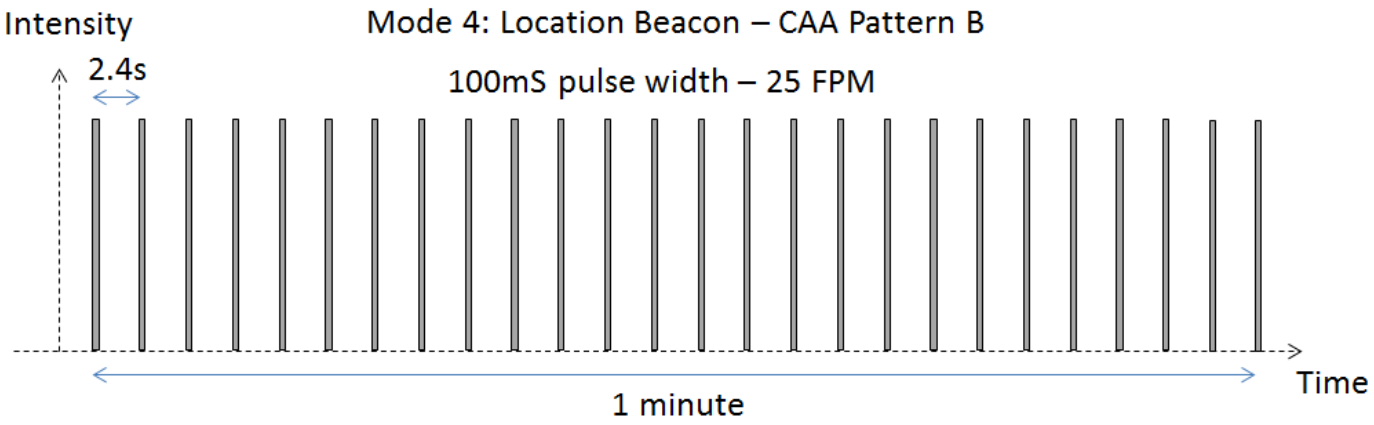
Apart from the items listed above, there are no other user-serviceable parts. Any repair would require the unit to be returned for repair or replacement.

## 17. Appendix 1 – Timings of Location Beacon Modes

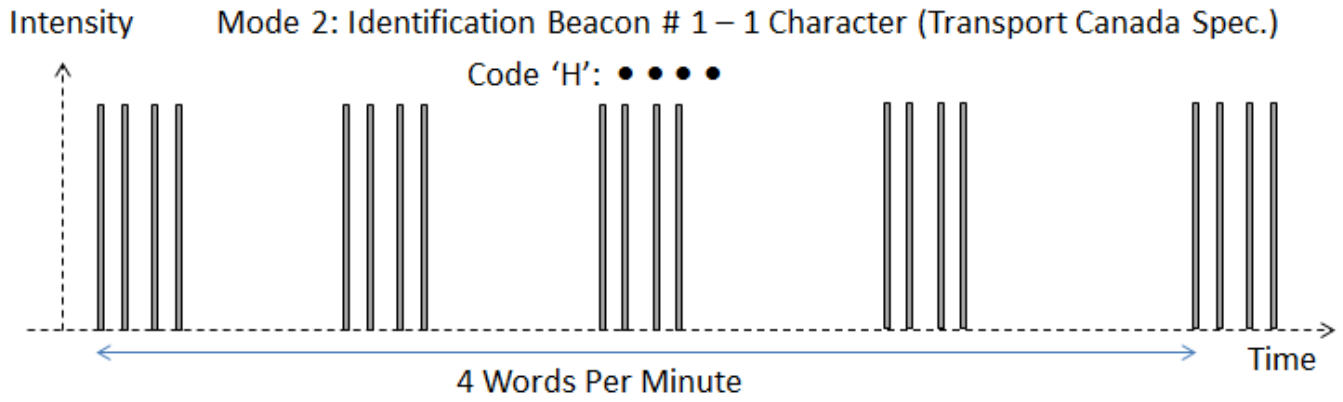


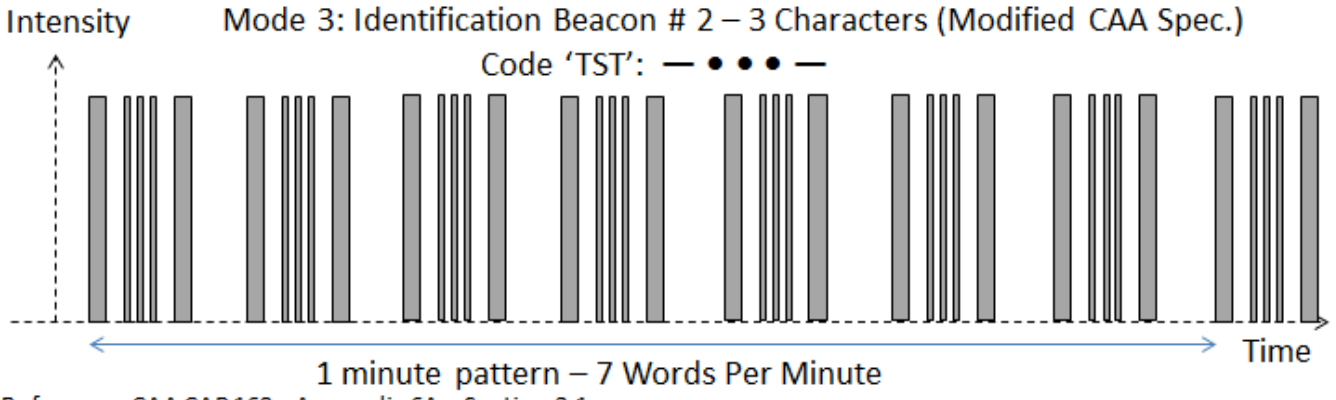

Reference: ICAO Volume II, Annex 14 - 5.3.2



## 18. Appendix 2 – Identification Beacon Modes




Reference: Transport Canada (23 October 2008). TC AGA


Intensity
Mode 3: Identification Beacon # 2 – 3 Characters (Modified CAA Spec.)
Code 'TST': — • • • —
Time
1 minute pattern – 7 Words Per Minute

Reference: CAA CAP 168 Appendix 6A – Section 2.1

**CAA Identification Beacon**

- 2 character Morse code
- Green light (White also mentioned)
- 6 to 8 words per minute
- Omnidirectional
- Minimum effective flash luminous intensity of 2000cd
- Visible at 10km
- Azimuth 1° to 45°

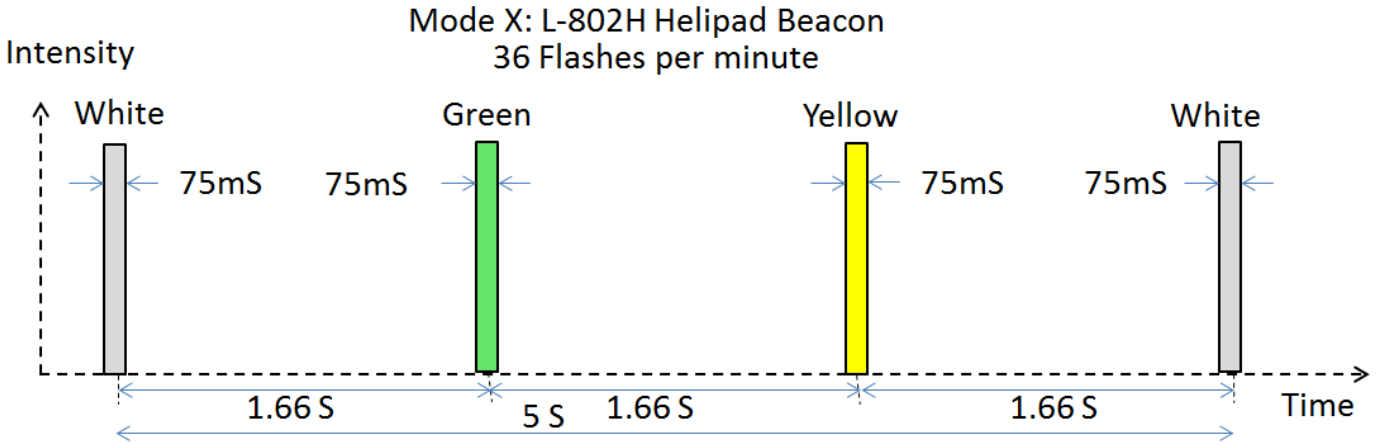
**Morse Specification**

- Reference period is the Morse 'dot'
- 1 dot =100mS (for this application)
- 1 dash is equal to 3 dots = 300mS
- Space between parts is equal to 1 dot = 100mS
- Space between characters is equal to 3 dots = 300mS
- Space between words is equal to 7 dots = 700mS
- For codes – see over

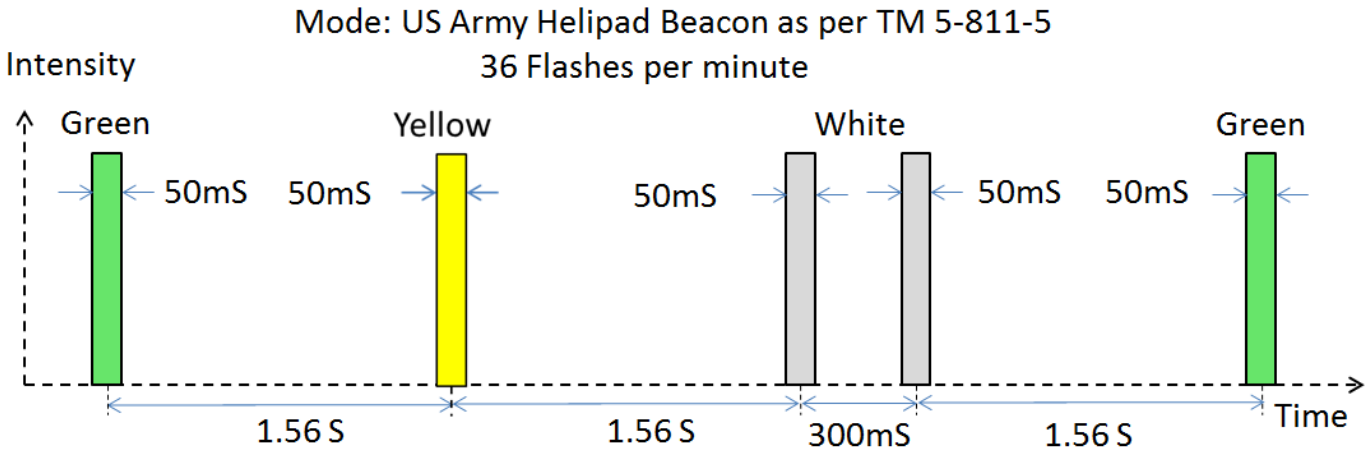
Reference: CAA CAP 168 Section 2 and Appendix 6A – Section 2.1

## 19. Appendix 3 – FAA Helipad Beacon Modes

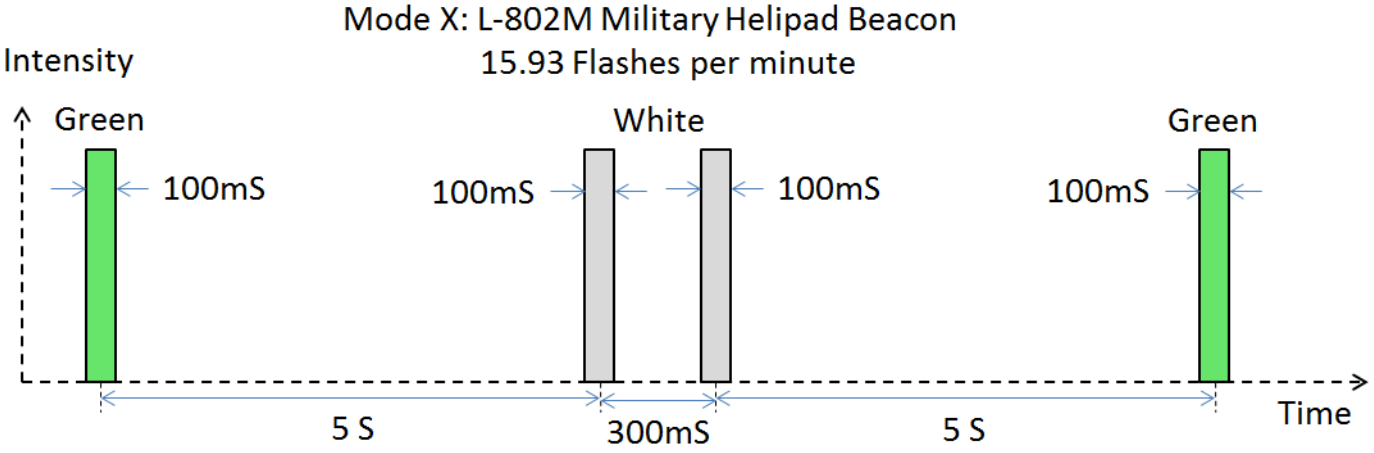
Mode 0: FAA L-802H Civil Helipad Beacon



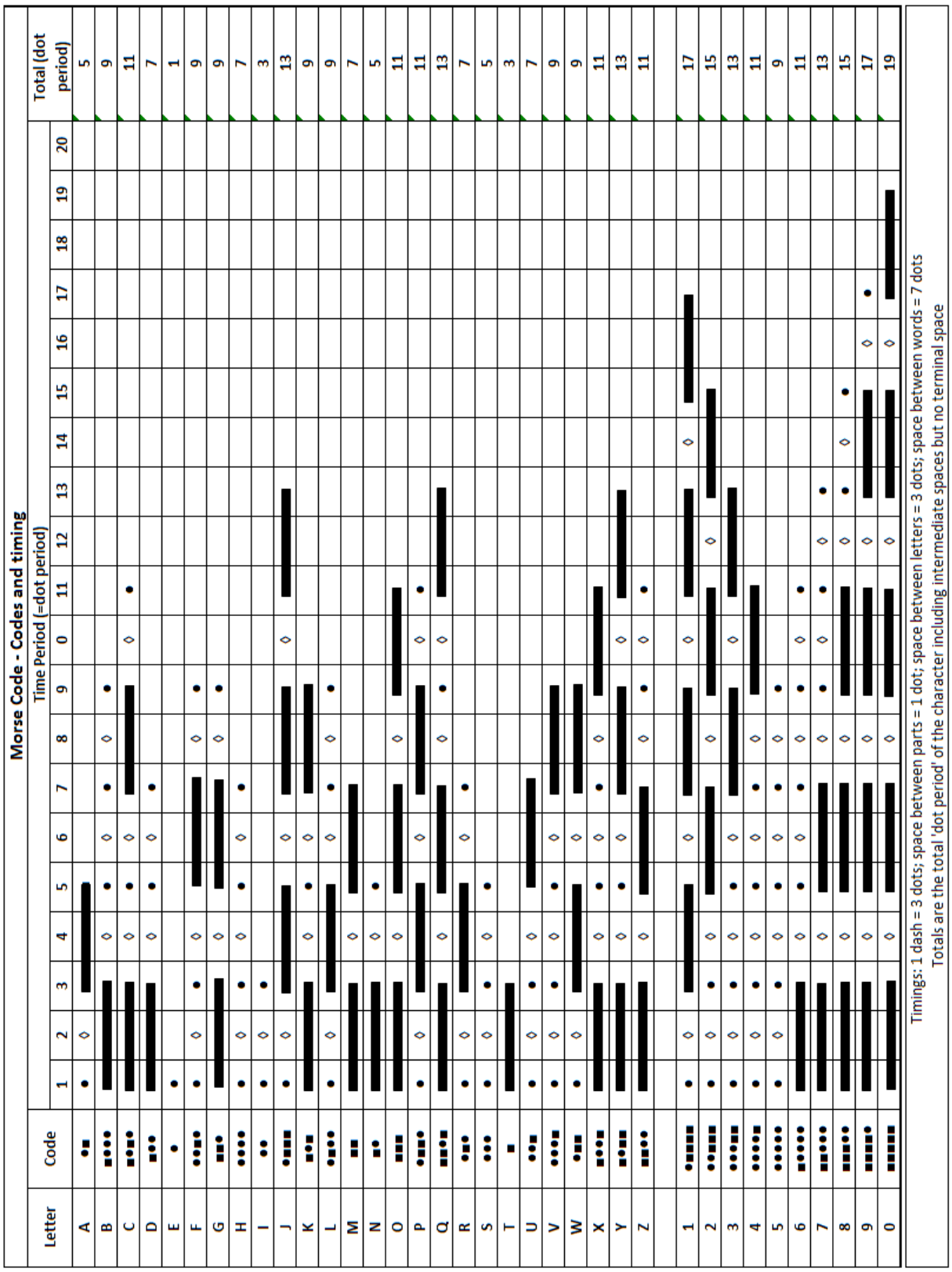

Mode 5: US Army Helipad Pattern (as per TM 5-811-5)




Mode 6: FAA L-802M Military Helipad Beacon



## 20. Appendix 4 – Morse Code Timing


Morse Code - Codes and timing
Time Period (=dot period)
Letter
Code
Total (dot period)
Timings: 1 dash = 3 dots; space between parts = 1 dot; space between letters = 3 dots; space between words = 7 dots
Totals are the total 'dot period' of the character including intermediate spaces but no terminal space

## 21. Appendix 5 – Diagnostics and Fault Finding

The following are the range of simple tests that an end-user of the beacon can perform – to be carried out in the order given.

**Warnings**

- Only fully qualified electricians/technicians should perform electrical testing of the unit, particularly the 110V-240V mains feed and Power Supply Unit.
- The beacon emits very high brightness light pulses. Do not look directly at the LED arrays or near reflections of the light.
- During normal operation the LED array can reach elevated temperatures that may cause burning. Do not touch the LED array until fully cooled

**Basic Configuration and Connection Checks – Ensure that:**

1. The beacon is properly mounted, secure and appears physically undamaged
2. If there are any signs of damage to any part of the beacon, power supply or wiring do not go any further but refer the unit to FEC for repair
3. The Power Supply Unit is properly connected to a live mains supply
4. The 24V DC feed wiring to the beacon is continuous and that all connections appear sound

**Beacon configuration Setting Switches – Ensure that:**

1. The Level Setting Switches are set to the required intensity
    a. See section 3
2. The Programme Switches are set to the required flash programme
    a. See section 5 & 6 – Single Colour Beacon
    b. See section 8 & 9 – Multi Colour Beacon
3. All of the Quadrant Enable Switches are set to **ON**
    a. See section 10

**Observational Testing**

Once all of the above have been checked, power the unit on. Under normal circumstances there will be a few seconds delay, all of the arrays will flash very quickly in turn and colour (the system is checking all of the arrays and colours) then the beacon will perform the selected programme.

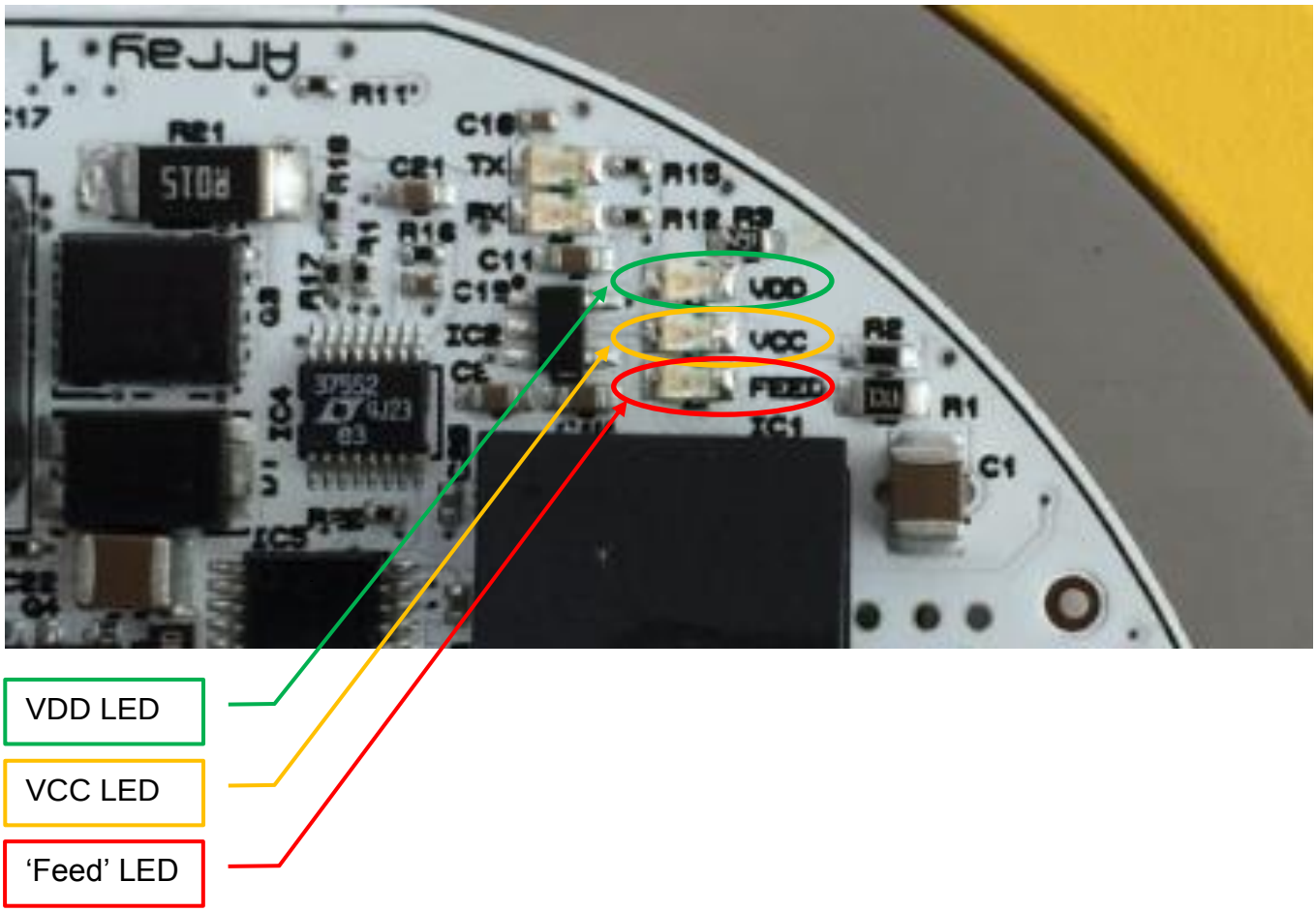
Note that the control system of the LED monitors a number of parameters to ensure that the beacon flashes consistently at the desired brightness. If it detects that this is not possible, it will not flash at all.

If it does not operate normally, check the status LEDs on the main circuit board (diagram on next page).

**Check status of the red 'Feed' LED**

1. Feed LED is illuminated – Power is being fed to the beacon and fuse is OK
2. Feed LED is not illuminated – Power is not being fed to the beacon OR the fuse is blown

***Image of status LEDs – V5.1 Hardware***




If a blown fuse is suspected then:

1. Disconect all power from the Power Supply Unit.
2. Remove the line fuse and test with a fuse tester or Ohm meter.
3. If the fuse is sound, replace it and re-try the tests.
4. If the fuse is blown, replace with spare fuse supplied. NB – repeated fuse blowing indicates a serious fault which must be reported to FEC.

If after above checks have been made and the Feed LED remains un-lit, either continue with the 'Electrical Tests' below or return beacon to FEC for checking.

If the red Feed LED is lit then proceed to check status of the orange VCC and green VDD LEDs.

**Check status of the yellow VCC LED**

- VCC LED is illuminated – The 5V voltage regulator is working

**Check status of the green VDD LED**

- VDD LED is illuminated – The 3.3V voltage regulator for the on-board processor is working

If both LEDs are lit then power is being provided to the beacon and its processor. If all of the switches have been correctly set and the beacon is still not working it indicates a fault that must be referred to FEC for rectification.

**Electrical Tests**

**Warning**

Only fully qualified electricians/technicians should perform electrical testing of the unit, particularly the 110V-240V mains feed and Power Supply Unit.

**Feed Voltage**

The beacon has a nominal feed voltage of either 12V or 24V DC with an absolute range of 11V to 28V. The +ve supply must be connected to +ve terminal of the power connector.

**- Polarity is critical -**

The beacon monitors its feed voltage and, if it is below 11V on start-up, will disable the LEDs and enter the Test and Diagnostic routine (as though program 7 had been selected). This is to ensure that both excessive current is not drawn from the supply and to ensure that the beacon only operates at the intended level of brightness.

One consequence of this is that if a supply with a slow 'rise time' (i.e. the time it takes to achieve its set voltage) is too slow the beacon may detect this as a low feed voltage and enter the Test and Diagnostics routine.

If a bench power supply is to be used for testing it must be set to 24V for testing and the current limit set to a minimum of 8 amps once initial tests have been performed.

If a bench power supply is used for the LED status checks above, it may be set to a low voltage and current limits (e.g. 12V and 200mA) but once this is completed, reset to the normal limits (24V/8A) and re-started for the full LED tests.

**Feed Current**

At the rated feed voltage of 24V the beacon's quiescent current is of the order of 100mA.

The beacon's peak current demand is >7 amps for the duration of the LEDs flash.

If the power supply used is not able to meet this peak demand, with no appreciable drop in voltage, the beacon may enter the Test and Diagnostic routine and the LEDs will not flash.

## 22. Appendix 6 - System Diagnostics

If the Programming Kit (with or without the wireless option) is available, the following parameters may be checked.

The best way to power a beacon not fitted with a wireless interface is to remove all power feeds to it and power via the USB lead of the programming kit. For beacons fitted with a wireless interface, power the beacon from a suitable power source – a laboratory power supply set at a low voltage is ideal.

**System**

Ensure that the Model, Hardware and Software are expected and match the labels on the LED and the base plate.

**Status**

Check that the Input Voltage matches the supply voltage and that the LED Array Temperature is showing the current temperature.

If the Array Temperature is not showing correctly (usually within a few degrees of room temperature) this may indicate a faulty temperature probe.

If the figure is extremely high (>100 degrees when the LEDs are not running) this clearly indicates a fault with the temperature probe which will lead to the unit running permanently at much reduced power and light output.

**Unit History**

Historical parameters are written at start-up and then every minute while the unit is running. When reviewing the data it is important that very short transients (e.g. a very high but short duration voltage spike) will not necessarily be captured and recorded. Never-the-less the data gives insights into the past operation of the unit.

***Maximum Input Voltage* -** A figure over 28V indicates that the unit has been over stressed.

***Maximum Array Temperature* –** A figure above 70 degrees would normally be expected. A figure up to 85degrees C is within limits but above that could indicate a fault or prolonged running at high ambient temperatures.

***Unit and Fan Run Times* -** If the Fan Run Time is nearly equivalent to the Unit Run Time it indicates prolonged running at high ambient temperatures.

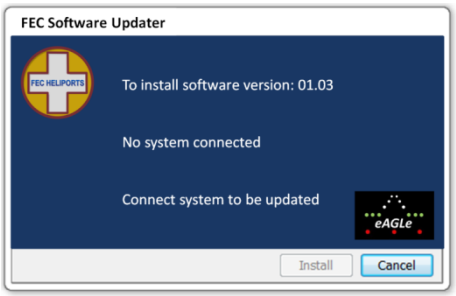
## 23. Appendix 7 - Software Updater – Beacon V5.x

The Beacon can be updated with new software by users. Software updates are available as downloads from the FEC website. Two formats are supported; executable (.exe) and self-extracting zip files. If your PC firewall prevents downloading of the .exe file, download and extract the zip file version.

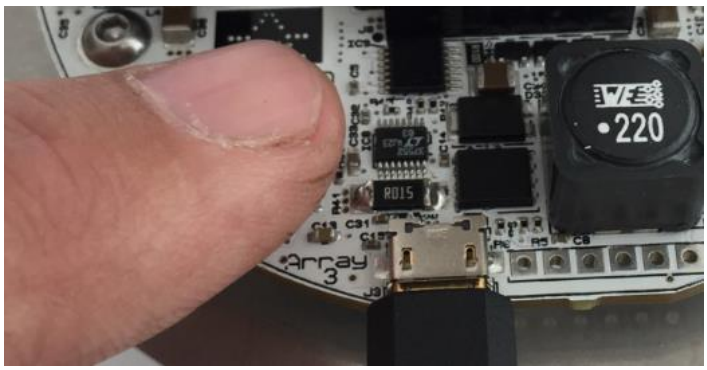
To update the software requires a Windows PC and a USB cable with type 'A' plug one end and **Micro** type 'B' the other. The installer requires neither software nor drivers to be installed on your PC – the standard Windows HID drivers already installed are used.

**To update the software:**

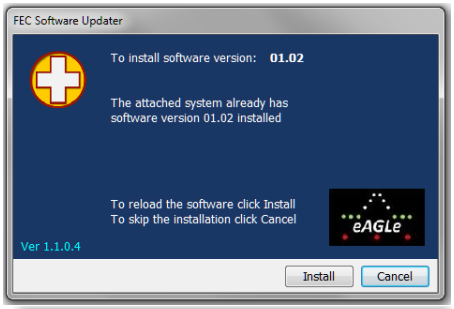
1) Disconnect the Beacon from the power supply
2) Connect the USB cable to the PC (not yet to the Beacon)
3) Double click on the update file and a screen similar to that to the right will appear




4) Hold down the 'Boot-loader' button at the same time as connecting to the USB port at the front of the PCB (image right) – this will power the Beacon from the PC




5) The screen on the PC should now advise that the system is connected and the Install button will have changed from greyed-out to active.
   - If screen does not confirm it is ready to install, remove the cable from the light and repeat from instruction 4
6) Click Install and the software will be automatically uploaded to the Beacon




7) A screen (right) confirms the update in progress
8) If Windows asks if the programme installed ok – click yes
9) Disconnect the USB cable
10) Re-connect the power
11) The Beacon will now be running the new software